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## Abstract:

A new extremely high stability atmospheric calibration system has been developed by JPL for use at the NASA Deep Space Network site in Goldstone, CA. This system is intended to calibrate both the dry and wet components of the neutral atmosphere, but in particular the fluctuations in path delay due to atmospheric water vapor that are anticipated to dominate the error budget for several radio science and radio astronomy experiments. The goal of the system is to demonstrate stability with an Allen standard of better than 3 x 10<sup>-15</sup> on time scales of a few thousand seconds. The first use of this system will be as part of the Gravitational Wave Experiment to be carried out with the Cassini spacecraft. The system consists of a new highly stable 22-31 GHz water vapor radiometer (WVR), a 50-55 GHz microwave temperature profiler (MTP), and a package of instruments that sense surface meteorology. Since high availability is required during Cassani Radio Science measurements (99.8%) the system is redundant. This paper will describe the instrumentation, data acquisition and data processing approach used to implement this system.